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ABSTRACT

This automotive chassis course is designed to familiarize the beginning student of the history and development of the automobile with basic concepts common to the automobile industry, and general information that is required for successful advancement in the automotive mechanics field. It is one quinmester in a series of quinmester outlines designed for complete automotive mechanics course (45 clock hours). Instruction consists of demonstrations, lectures, group discussions, audiovisual aids and resource people from industry. A course outline is provided along with 18 pages of post-tests and answer keys. (DS)

ED 092704

VT

AUTHORIZED COURSE OF INSTRUCTION FOR THE QUINMESTER PROGRAM

DADE COUNTY PUBLIC SCHOOLS

DIVISION OF INSTRUCTION • 1973

1-27

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Course Outline
AUTOMOTIVE MECHANICS - BASIC - 9043
(Automotive Chassis)
Department 48 - Quin 9043.02

CEC01433

ED 092704

D A D E C O U N T Y P U B L I C S C H O O L S

1 4 5 0 N O R T H E A S T S E C O N D A V E N U E

M I A M I, F L O R I D A 33132

Course Outline

AUTOMOTIVE MECHANICS - BASIC - 9043
(Automotive Chassis)

Department 48 - Quin 9043.02

county office of

VOCATIONAL AND ADULT EDUCATION

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Dr. E. L. Whigham, Superintendent of Schools
Dade County Public Schools
Miami, Florida 33132

December, 1972

Published by the School Board of Dade County

Course Description

9043	48	9043.02	Automotive Chassis
State Category Number	County Dept. Number	County Course Number	Course Title

The main objective of this course is to familiarize the beginning student with the history and development of the automobile with basic concept common to the automobile industry, and general information that is required for successful advancement in the automotive mechanics field. This is a one or two quinmester course.

Indicators of Success: An eighth grade equivalency score in reading comprehension, a basic knowledge of arithmetic fundamentals, and an aptitude for mechanical achievement.

Clock Hours: 45

PREFACE

The following quinmester course outline is a guide to help students become employable by teaching them the skills, knowledge, attitudes and values necessary for performing the required services of the automotive suspension, alignment and brake system.

This course is designed as a foundation course for the automotive engine mechanic. The outline consists of three blocks of instruction, which are subdivided into several units each, covering 90 hours of instruction. It is one quin in a series of quin outlines designed for the complete automotive mechanic course.

Indicators of success in this course are as follows: an eighth grade equivalency score in reading comprehension, a basic knowledge of arithmetic fundamentals, and an aptitude for mechanical achievement.

Instruction consists of demonstrations, lectures, group discussions, audiovisual aids and resource people from industry. Instruction is flexible in order to meet individual needs and abilities.

The bibliography appearing on the last page of this outline lists several basic references along with supplementary references and audio-visual aids.

This outline was developed through the cooperative efforts of the instructional and supervisory personnel, the Quinmester Advisory Committee, and the Vocational Curriculum Materials Service, and has been approved by the Dade County Vocational Curriculum Committee.

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With Suggested Hourly Breakdown

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BLOCK

I. AUTOMOTIVE SPRINGS AND SUSPENSIONS (50 Hours)

Function of Springs	1
Types of Springs	1
Nomenclature of Parts	1
Sprung and Unsprung Weight	1
Characteristics of Springs	1
Leaf Spring Installation	1
Rear Suspensions	1
Front Suspension Systems	1
Steering Systems	1
Steering Gears	2
Steering and Suspension Problems	2
Principles of Wheel Balance	2

II. AUTOMOTIVE BRAKES (40 Hours)

Friction	3
Hydraulic Principles	3
Hydraulic System Components	3
Brake Classification	3
Diagnosing Brake System Malfunctions	4

III. QUINMESTER POST-TEST

APPENDIX: QUINMESTER POST-TEST SAMPLES	7

GOALS

The automotive mechanics trainee must be able to demonstrate:

1. A basic understanding of the automotive suspensions, alignment and brake fundamentals and component parts of each system.

2. A desire to continue with more advanced training within the automotive occupational field.

3. Positive attitudes regarding the value and dignity of work.

4. Good safety habits and shop behavior.

5. Knowledge of the various skills and technical knowledge necessary for a successful career in the automotive field.

SPECIFIC BLOCK OBJECTIVES

BLOCK I - AUTOMOTIVE SPRINGS AND SUSPENSIONS

The student must be able to:

1. Identify, in writing, two types of front suspension systems, and describe, in writing, the construction of both types.
2. Explain, in writing, the difference between sprung and unsprung weight.
3. Explain, in writing, the purpose and construction of double-acting shock absorbers.
4. Identify, in writing, two types of power steering pumps.
5. Write in the names of suspension component parts with seventy-five percent accuracy, given several drawings of various suspension, components.

BLOCK II - AUTOMOTIVE BRAKES

The student must be able to:

1. Identify the individual parts that make up a typical tandem master cylinder.
2. Define "Pascal's Law of Hydraulics."
3. Write a paragraph on the effect of air in the hydraulic system.
4. Explain the differences in operation of servo and nonservo brakes.
5. Compute brake shoe.

BLOCK III - QUINMESTER POST-TEST

The student must be able to:

1. Satisfactorily complete the quinmester post-test.

Course Outline

AUTOMOTIVE MECHANICS - BASIC - 9043
(Automotive Chassis)

Department 48 - Quin 9043.02

I. AUTOMOTIVE SPRINGS AND SUSPENSIONS

A. Function of Springs

B. Types of Springs

C. Nomenclature of Parts
1. Coil springs
2. Leaf springs
3. Torsion bar
4. Air suspension
5. Hydrostatic suspension

D. Sprung and Unsprung Weight

E. Characteristics of Springs
1. Rate
2. Hookes Law

F. Leaf Spring Installation
1. Spring hanger
2. Spring shackle

G. Rear Suspensions
1. Function
2. Rear and torque
   a. Hotchkiss drive
   b. Torque-tube drive
   c. Torque arm systems

H. Front Suspension Systems
1. Independent front suspension
   a. Nomenclature of parts
   b. Coil spring
   c. Solid axle or "I" beam
2. Shock absorbers
   a. Compressed air
   b. Hydraulic
   c. Spring oscillations

I. Steering Systems
1. Function of the steering system
   a. Standard steering and general steering
   b. Steering linkages
   c. Nomenclature and parts
2. Tilt steering wheel and column

J. Steering Gears
   1. Power steering
      a. Identification of steering gears
         (1) Manufacturer's name
         (2) Physical construction
         (3) By automobile application
         (4) Types of pumps
      b. In-line power steering
      c. Linkage type power steering
      d. Nomenclature
   2. Steering gear service

K. Steering and Suspension Problems
   1. Trouble shooting
      a. Excessive play in system
      b. Hard steering
      c. Car wander
         (1) While driving
         (2) During braking
      d. Front-wheel shimmy (low speed)
      e. Front-wheel tramp or high speed shimmy
      f. Steering kickback
      g. Tires squeel on turns
      h. Abnormal tire wear
         (1) Underinflation
         (2) Overinflation
         (3) Excessive camber
         (4) Excessive toe-in or toe-out
         (5) Cornering
      i. Hard or rough ride
      j. Sway on turns
      k. Sagging springs
   2. Servicing steering linkage and suspensions
      a. Front-end alignment
         (1) Camber
         (2) Steering-axis or kingpin inclination
         (3) Included angle
         (4) Caster
         (5) Toe-in
         (6) Toe-out during turns
      b. Preliminary checks
      c. Type of equipment used
      d. Safety precautions

L. Principles of Wheel Balance
   1. Dynamic balance
   2. Static balance
      a. Safety
      b. Riding comfort
      c. Extended tire wear
   3. Tire conditions and their effect on wheel balance
      a. Tire wear conditions
      b. Tread run-out
   4. Wheel and rim, problems

I. AUTOMOTIVE SPRINGS AND SUSPENSIONS (Contd.)

a. Eccentricity
b. Lateral run-out
5. Types of wheel balancers

II. AUTOMOTIVE BRAKES

A. Friction
1. Static
2. Kinetic
a. Heat
(1) Generation by friction
(2) Dissipation
b. Transfer of energy
c. Factors controlling friction
(1) Area of contact
(2) Material
(3) Pressure
d. Product of friction
(1) Heat
(2) Wear

B. Hydraulic Principles
1. Pressure applied to liquids
a. Noncompressable characteristics
b. Pascal's principles for liquids under pressure
c. Relation of force multiplication to cylinder area
2. Application to the brake system
a. Transmission of effort
b. Multiplication of force
3. Work safety precautions

C. Hydraulic System Components
1. Master cylinder
a. Function
b. Types
c. Nomenclature
d. Principles of operation
e. Reconditioning
2. Wheel cylinder
a. Operating principles
b. Reconditioning

D. Brake Classification
1. Self-adjusting brakes
a. Star wheel rotating type cable-operated
b. Star wheel rotating type lever-operated
c. Nomenclature of parts
2. Disc brake
a. Chrysler self-adjusting
b. Caliper
c. Antiskid devices

d. Principles of operation
e. Nomenclature of parts

3. Power brakes
   a. Theory of operation
      (1) Pressure
      (2) Vacuum
   b. Servicing
4. Parking brake
   a. Rear wheel type
      (1) Hand-operated
      (2) Foot-operated
   b. Transmission type
      (1) Internal
      (2) External
   c. Replacement and adjustment
   d. Nomenclature of parts

E. Diagnosing Brake System Malfunctions
   1. Conventional
   2. Mechanical
   3. Power
   4. Disc
   5. Safety procedures
   6. Bleeding the brake system
   7. Flushing the hydraulic system

III. QUINMESTER POST-TEST

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Basic References:

1. Crouse, William H. Automotive Mechanics. 5th ed. New York: Webster Division, McGraw-Hill Book Co., 1965. Pp. 616.

2. Glenn, Harold T. Automechanics. Peoria, Illinois: Charles A. Bennett Co., Inc., n.d. Pp. 478.

Workbooks and Instructional Manuals:

3. Evolution of Brakes. Course 2000. Dearborn, Michigan: Ford Motor Company.

4. Steering and Suspension Principles. Course 3000. Dearborn, Michigan: Ford Motor Company.

5. Wagner Hydraulic Brake Service Manual. St. Louis, Missouri: Wagner Electric Corp., Parts and Accessories Division.

6. Wheel Alignment. Course 3000.5. Dearborn, Michigan: Ford Motor Company.

A P P E N D I X

Quinmester Post-Test Samples

Quinmester Post-Test 1

Name _____ Date _____ Score ___

1. How is tension increased on torsion bars:

   a. By flexing
   b. By compressing
   c. By twisting

2. What is curb weight:

   a. Vehicle weight without passengers or load
   b. Vehicle weight with driver and no load
   c. Vehicle weight with driver and normal load

3. What is the main function of a shock absorber:

   a. To control spring action
   b. To prevent side sway of vehicle
   c. To provide stability on turns

4. What material is usually used in the manufacture of brake drums:

   a. Cast iron
   b. Wrought iron
   c. Steel

5. What is the main advantage of using aluminum in brake drums:

   a. Lighter weight
   b. More economical to produce
   c. Better heat dissipation

6. What is the limit of diameter oversize when reconditioning brake drum:

   a. _____ .030 in.
   b. _____ .060 in.
   c. _____ .125 in.

7. What is the special function of a dual or tandem master cylinder:

   a. Holds twice as much fluid
   b. Give twice as much hydraulic pressure to wheel cylinders
   c. Permits separate system for front and rear brakes

8. What is the purpose of a check valve in a master cylinder:

   a. Holds fluid in wheel cylinders and lines under residual pressure
   b. Keeps fluid from circulating within master cylinder
   c. Maintains hydraulic balance between fluid in cylinder and fluid in reservoir

9. What is the usual cause of a fading brake pedal if there is no fluid leak:

   a. Faulty primary cup in master cylinder
   b. Faulty secondary cup
   c. Defective check valve

10. What should be done if the brake pedal is tight against the floor pan and the wheels are locked:

   a. Adjust brake pedal free play
   b. Back off star wheel adjusters
   c. Bleed brake system

11. Excessive positive camber will cause tire wear around:

   a. The outer edge
   b. The inner edge
   c. The center
   d. Both inner and outer edge

12. Positive caster:

   a. Proves for easier turning
   b. Wears tires
   c. Increases SAI
   d. Increases steering stability
   e. Decreases steering stability

13. Excessive toe-in will cause tire wear that is:

   a. Smooth
   b. Rough with flat spots
   c. Feathered edge treads
   d. Excessive in the middle of the tire

14. The factor contributing greatest to steering stability is:

   a. Caster
   b. Camber
   c. SAI
   d. Toe-in
   e. Toe-out-on-turn

15. Toe-in is measured:

   a. In degrees
   b. In fractions
   c. In decimals
   d. Across the tops of the tires
   e. With the wheels turned

16. Loose wheel bearings may cause tire wear because they allow a change in:

    a. Caster
    b. Camber
    c. SAI
    d. Turning radius

17. Wheels tend to toe-out on a moving vehicle because of the relationship between:

    a. Vehicle wheelbase
    b. Steering axis pivot point and tire friction point
    c. Comparative length of upper and lower control arms
    d. Included angle and camber

18. The sideways motion of the tire against the road during bounce and rebound is known as:

    a. Scrob radius
    b. Toe-out
    c. Jounce angle
    d. Scuff travel

19. Camber is measured:

    a. With a steel rule
    b. In fractions
    c. With the vehicle in jacks
    d. In degrees

20. Caster angle is measured:

    a. In degrees
    b. With a caster bar
    c. In its relationship to a horizontal line
    d. In fractions

21. The pivot point on a vehicle with negative caster:

    a. Is behind the drag or friction point
    b. Intersects the wheel center line at the road
    c. Is ahead of the drag point
    d. Does not affect steering

22. Included angle is the combination of:

    a. SAI and camber
    b. SAI and caster
    c. Camber and caster
    d. Toe-in and toe-out-on turns

23. Toe-out-on turns is determined by:

a. Steering arm angle
b. Control arm angle
c. King pin angle
d. Camber angle

24. Overinflation causes tires to wear:

a. On the outer edge
b. On the inner edge
c. On both edges
d. In the middle

25. When a condition exists wherein all four wheels have a tendency to lock up with no brakes applied, the trouble is most likely to be in the:

a. Wheel cylinder
b. Master cylinder
c. Brake drum
d. Brake shoe

26. If vehicle brake shoes are replaced and the wheel cylinders are not overhauled, the cylinders will generally start to leak because:

a. New shoes cause more pressure in the lines
b. They are made to last only as long as the shoe lining
c. The wheel cylinder pistons and cups must not operate in a different position within the cylinder
d. The new brake shoes generate so much more heat that it deteriorates the rubber cups

27. The brake master cylinder:

a. Converts physical force into hydraulic pressure
b. Is simply a reservoir for fluid
c. Is connected to the wheel cylinders by mechanical linkage

28. The statement "liquid cannot be compressed under ordinator pressures":

a. Is a basic law of hydraulics
b. Is not factual
c. Has nothing to do with hydraulics

29. In the hydraulic brake system:

a. Pressure is the same at all points in the system
b. Force and pressure are the same at all point in the system
c. Force is the same at all points

30. The tendency of a brake shoe to wrap itself into the drum is usually referred to as:

a. Compound action
b. Self-energizing action
c. Mechanical advantage

31. When a vehicle is being braked to a stop:

a. Kinetic energy is being changed to heat energy
b. Heat energy is being changed to kinetic energy
c. Energy is being destroyed

32. The relative tendency of one material to resist sliding over another is properly referred to as its:

a. Coefficient of friction
b. Latent heat capability
c. Static kinetic coefficient

33. The self-adjusting action on the disc brakes is performed by the:

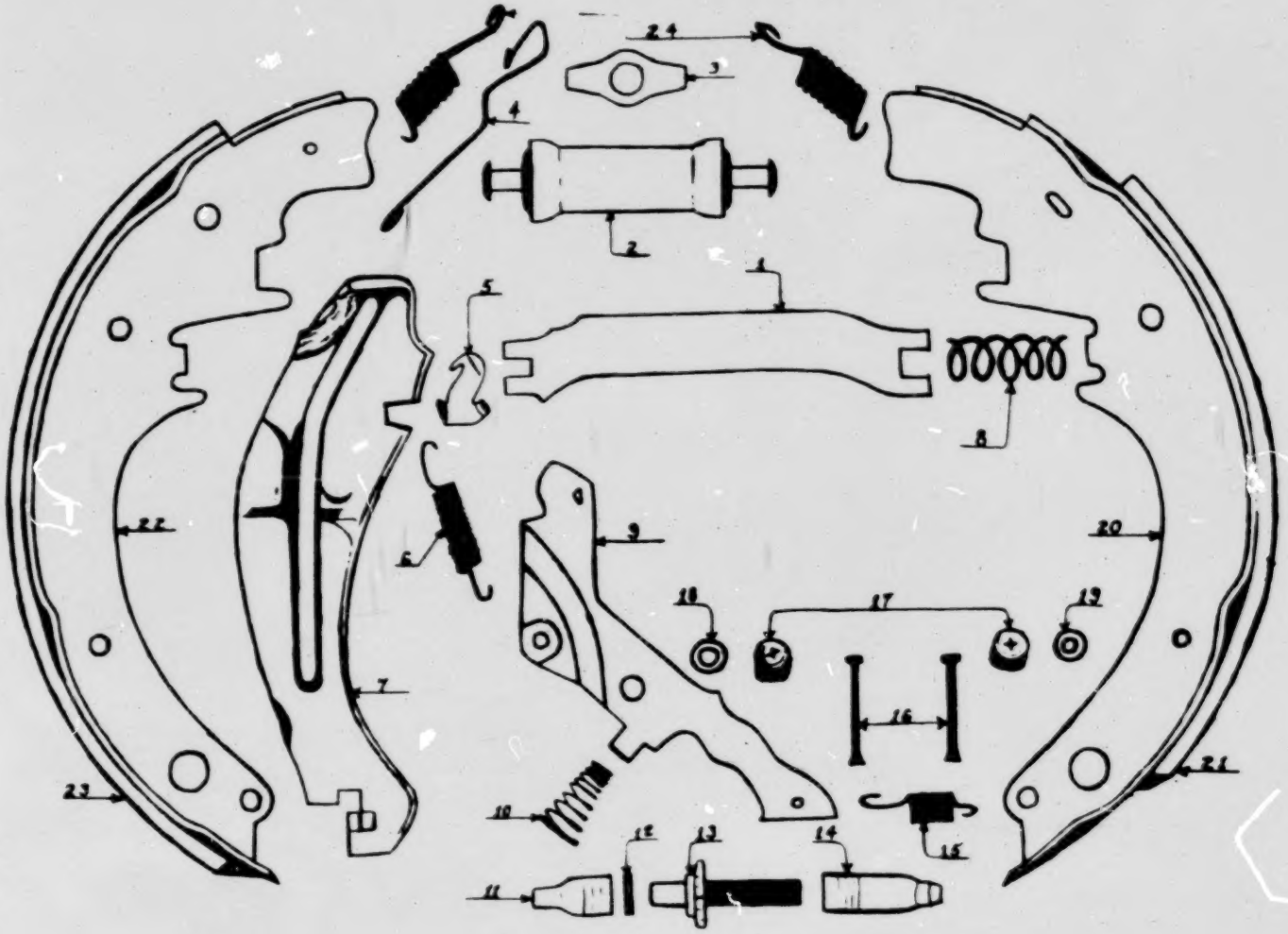
a. Check valve in the master cylinder
b. Anchor plate
c. Caliper piston seals

Quinmester Post-Test 2

Name _____ Date _____ Score ____

G. M. Self-Adjusting Brake

On the lines numbered 1-23, write in the name of the parts making up the exploded view. Use the accepted trade name for each of the parts.



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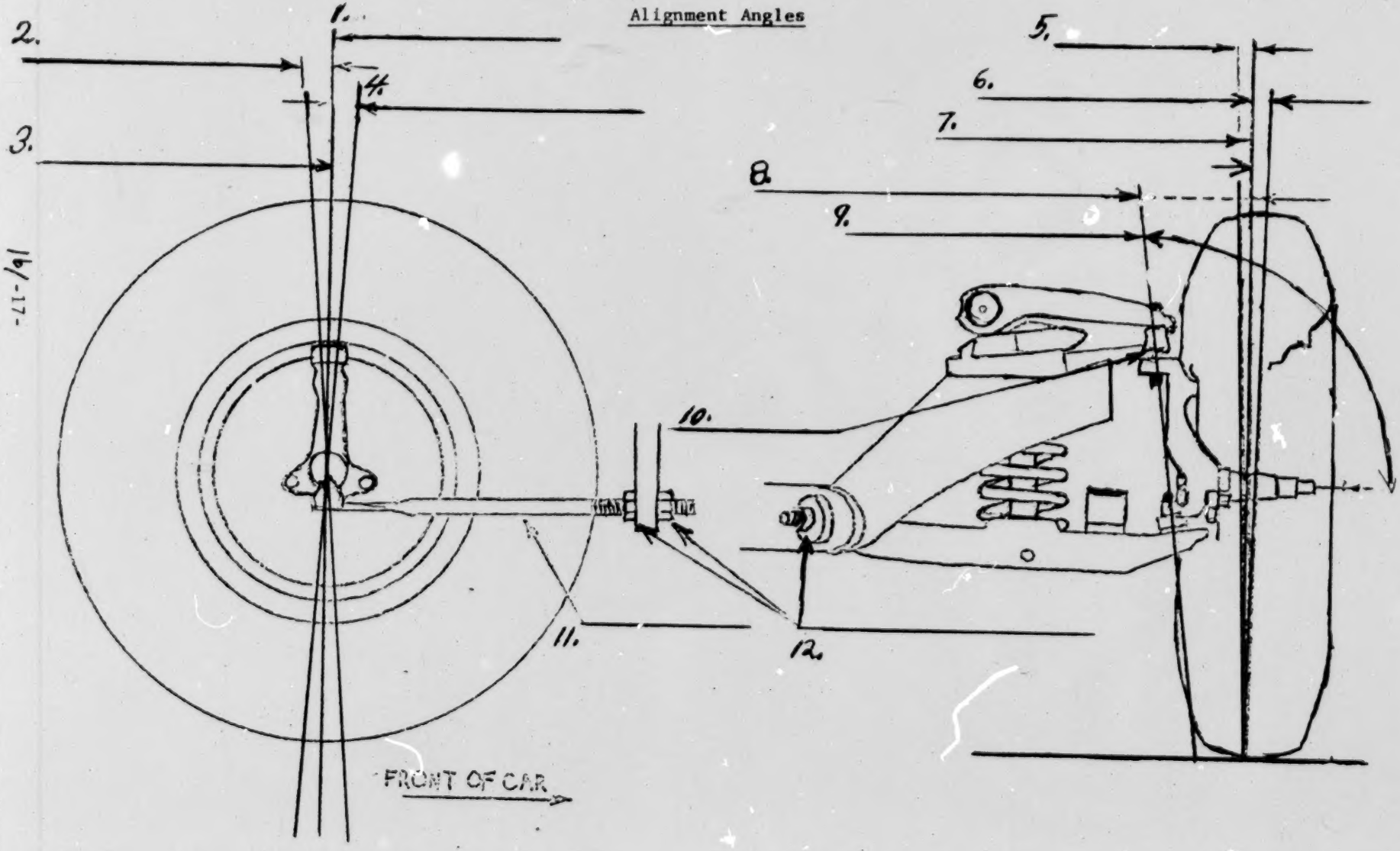
18. _____
19. _____
20. _____
21. _____
22. _____
23. _____

Quinmester Post-Test 3

Name _____ Date _____ Score ____

On the lines forming the arrows, write in the name of the angles and parts of a cadillac front-end suspension. Use the accepted trade name for each

Alignment Angles



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Quinmester Post-Test 4

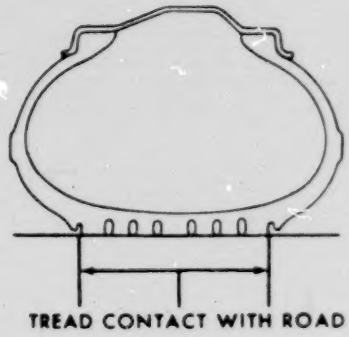
Name _____ Date _____ Score ____

Uneven Tire Wear

Write in the correct answer for each tire problem as numbered 1-9 below.

1

2



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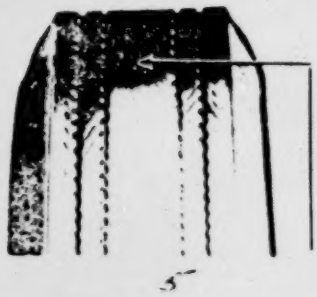

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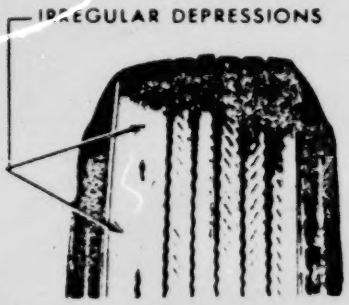

6

7

1. _____
2. _____
3. _____
4. _____
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6. _____
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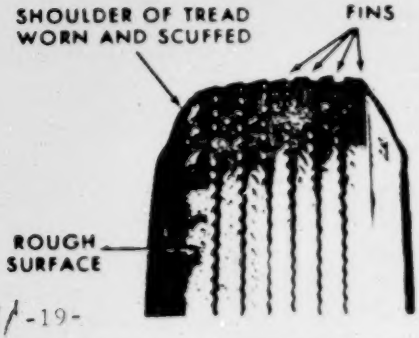
8. _____
9. _____

8



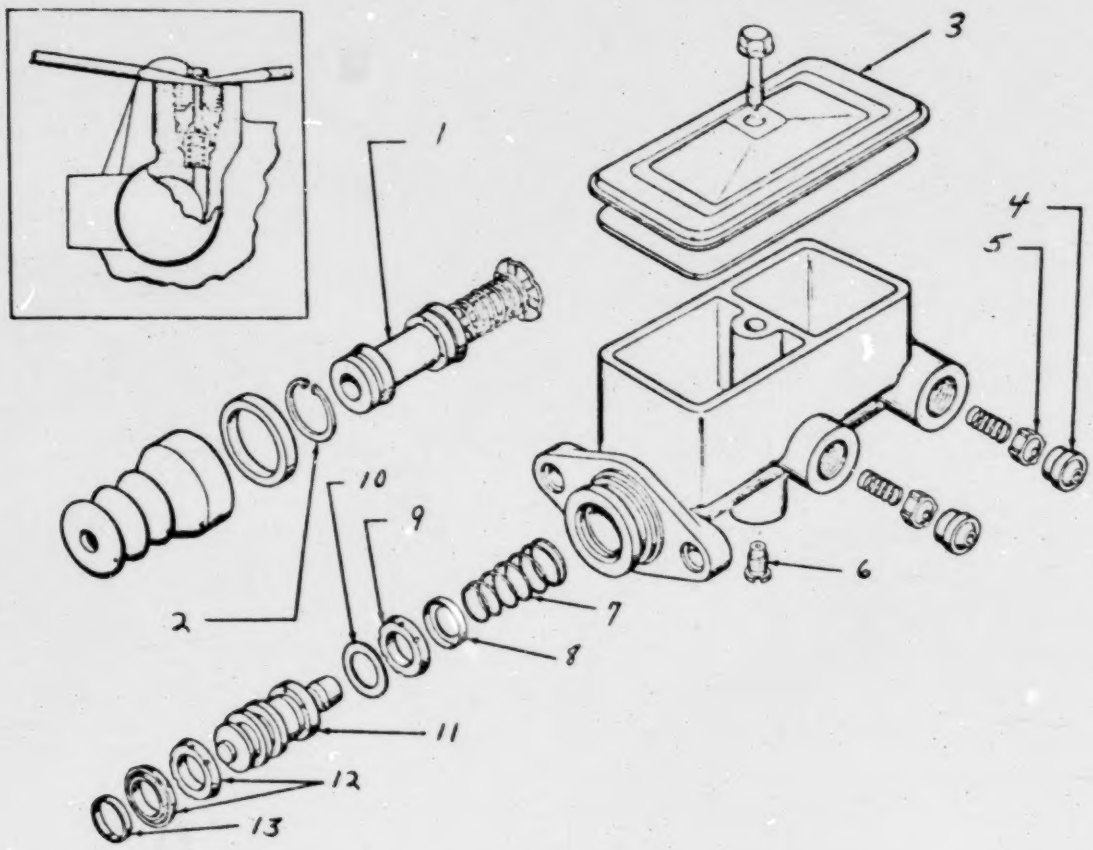
9

Quinmester Post-Test 5

Name _____ Date _____ Score ____

Bendix Tandem Master Cylinder (Improved)

On the lines numbered 1-13, write in the name of the parts making up the exploded view. Use the accepted trade name for each of the parts.



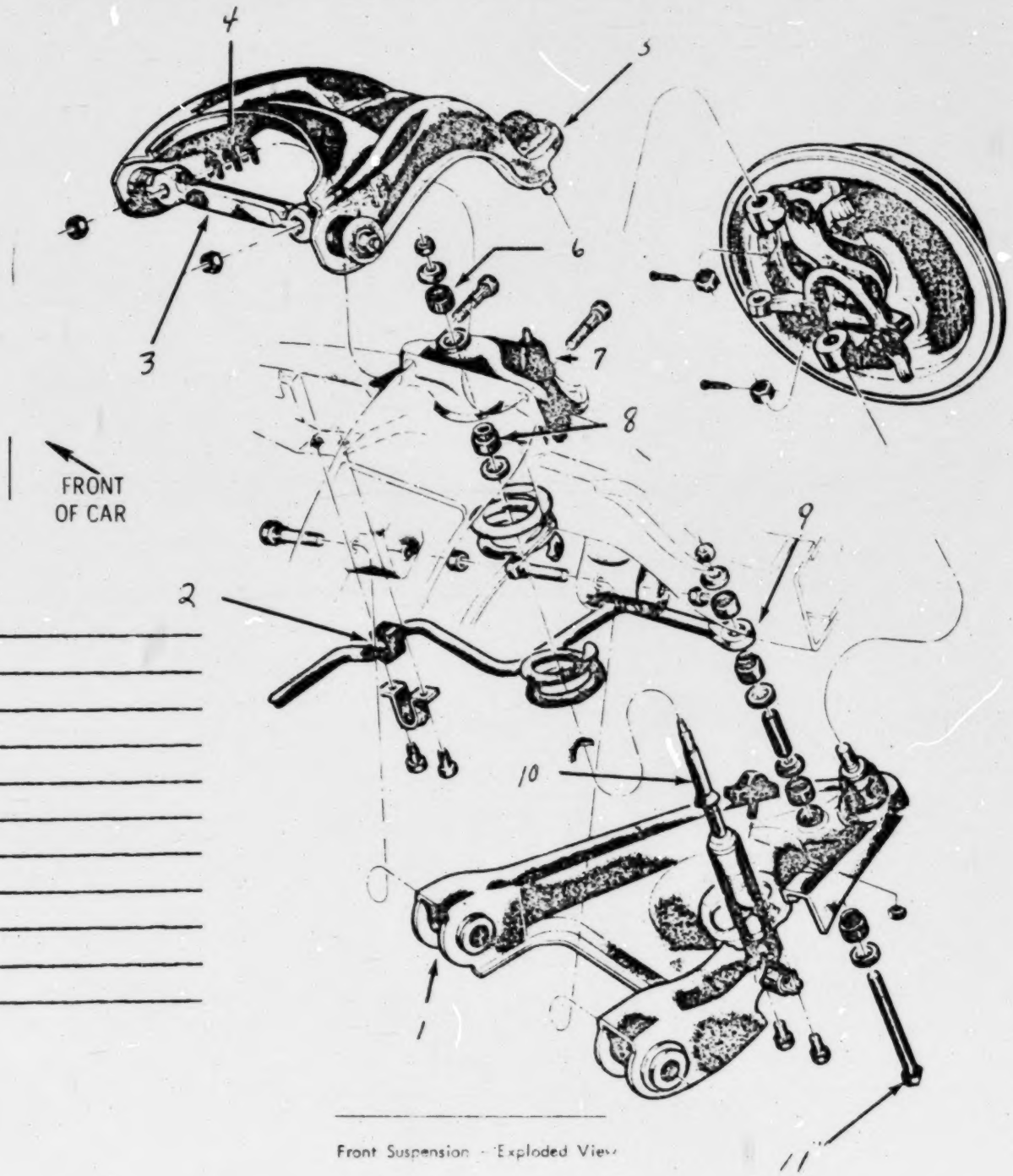
1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____
13. _____

Quinmester Post-Test 6

Name _____ Date _____ Score ____

Front Suspension

On the lines numbered 1-11, write in the name of the parts making up the exploded view. Use the accepted trade name for each of the parts.



1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____

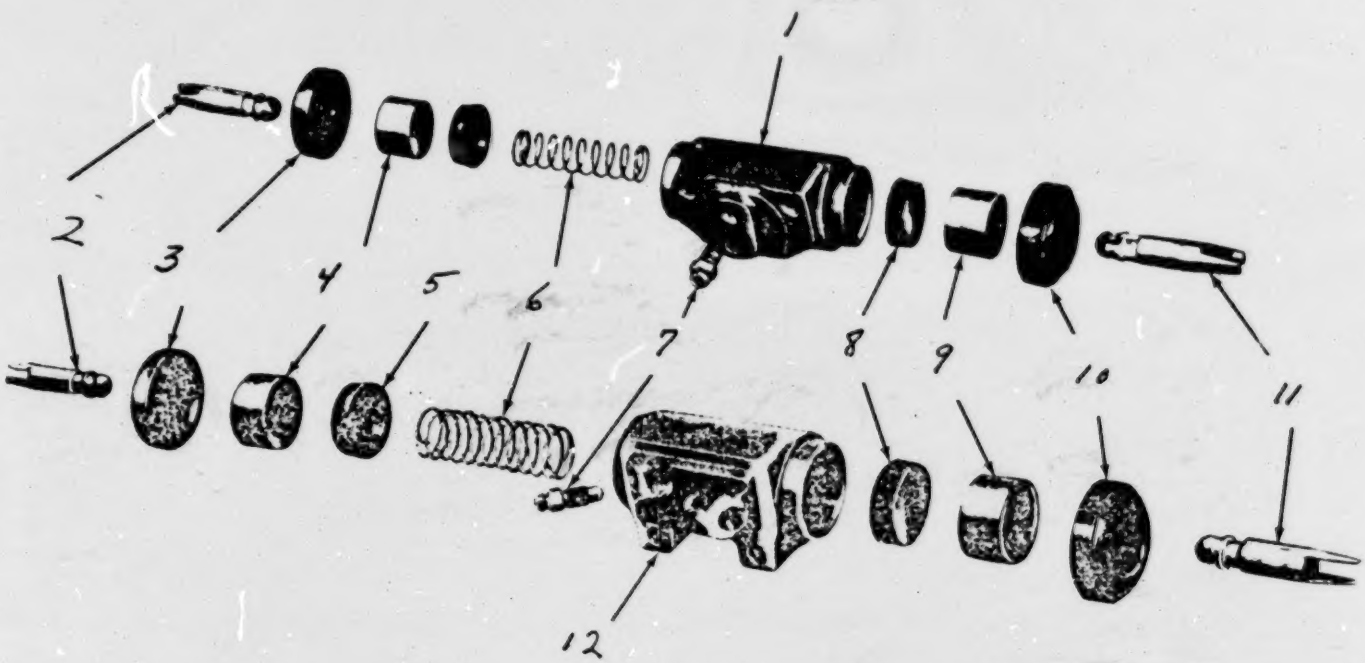
Front Suspension - Exploded View

Quinmester Post-Test 7

Name _____ Date _____ Score ____

Wheel Cylinders - Drum Brakes

On the lines numbers 1-12, write in the name of the parts making up the exploded views of two hydraulic brake wheel cylinders. Use the accepted trade name for each of the parts.



- Wheel Cylinders

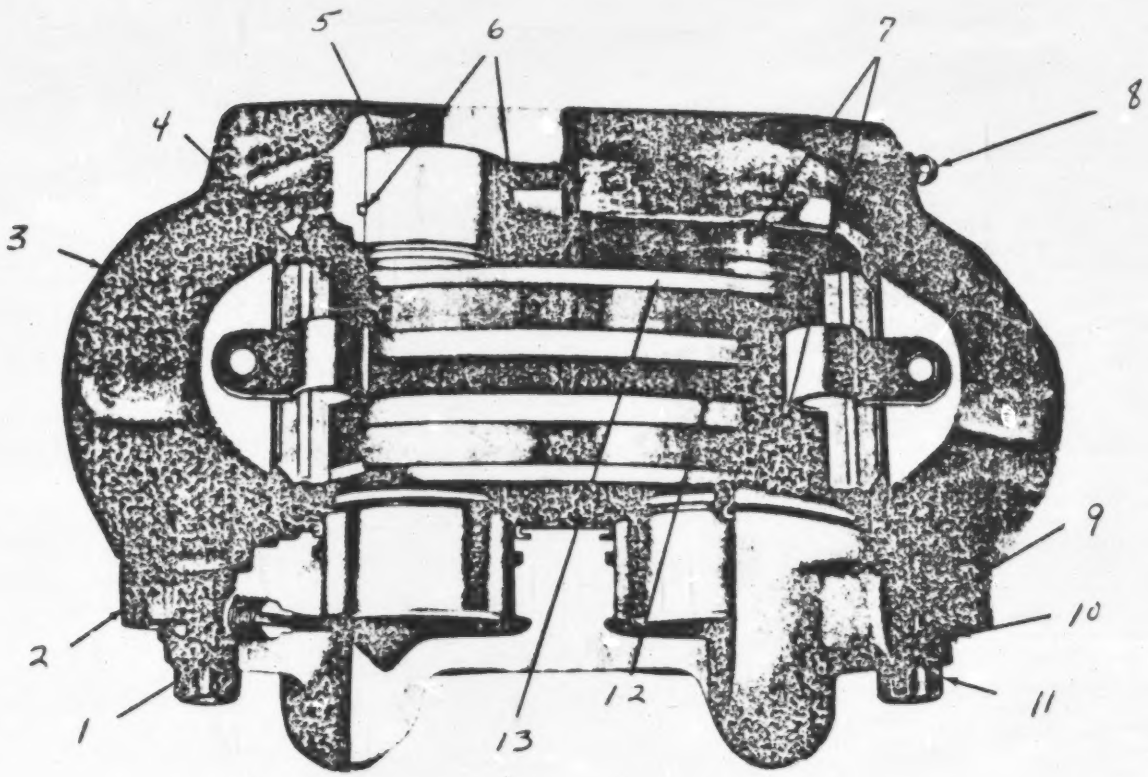
1. _____ 7. _____
2. _____ 8. _____
3. _____ 9. _____
4. _____ 10. _____
5. _____ 11. _____
6. _____ 12. _____

Quinmester Post-Test 8

Name _____ Date _____ Score ____

Disc Brakes - Fixed Caliper

On the lines numbered 1-13, write in the name of the parts making up the exploded view. Use the accepted trade name for each of the parts.



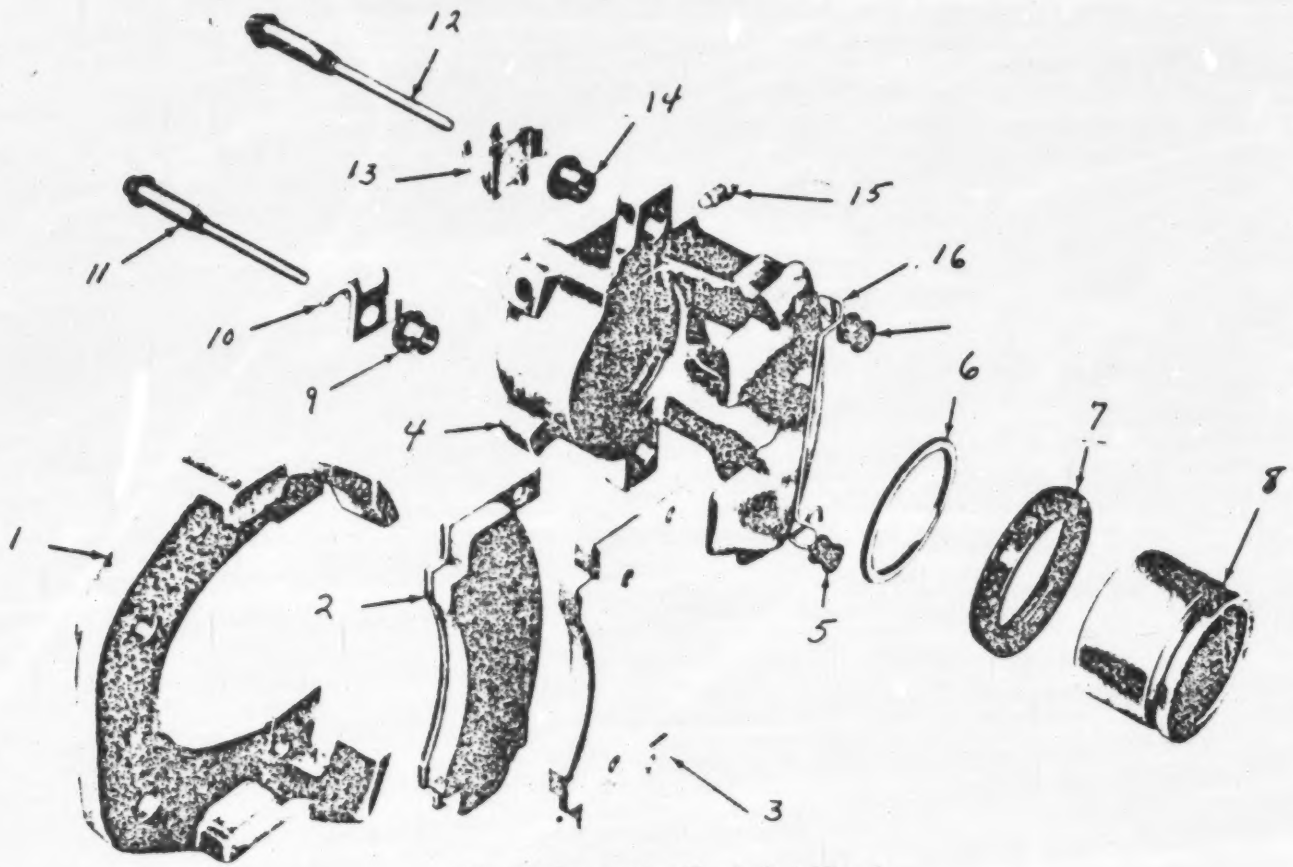
1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____
13. _____

Quinmester Post-Test 9

Name _____ Date _____ Score ____

Disc Brake - Floating Caliper

On the lines numbered 1-16, write in the name of the parts making up the exploded view. Use the accepted trade name for each of the parts.



Caliper Assembly (Exploded View)

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____
13. _____
14. _____
15. _____
16. _____

ANSWER KEY FOR QUINMESTER POST-TESTS

Test 1

1. 3	12. 2	23. 1
2. 1	13. 3	24. 4
3. 1	14. 3	25. 2
4. 1	15. 2	26. 3
5. 3	16. 2	27. 1
6. 2	17. 2	28. 1
7. 3	18. 4	29. 2
8. 1	19. 4	30. 2
9. 1	20. 1	31. 1
10. 1	21. 1	32. 1
11. 1	22. 1	33. 3

Test 2

1. Strut	13. Adj. nut
2. Wheel Cyl.	14. Pivot nut
3. Guide	15. Spring
4. Actuating link	16. Pin
5. Pivot	17. Hold down spring
6. Override spring	18. Sleeve
7. Lever	19. Washer
8. Spring	20. Pri shoe
9. Adj. lever	21. Primary lining
10. Return spring	22. Secondary shoe
11. Socket	23. Sec. lining
12. Washer, thrust	24. Return spring

Test 3

1. Steering axis
2. Positive caster angle
3. Vertical
4. Negative caster angle
5. Negative camber angle
6. Positive camber angle
7. Vertical
8. Steering axis angle
9. Steering axis
10. Camber eccentric adjustment
11. Tie strut
12. Caster adjusting nuts

Test 4

1. Underinflation
2. Overinflation
3. Proper inflation
4. Underinflation
5. overinflation
6. Multi-problem
7. Toe-in wear
8. Camber wear
9. Conering wear

Test 5

1. Primary piston assembly
2. Snap ring
3. Reservoir cover
4. Tube seat insert
5. Check valve
6. Piston stop
7. Secondary piston return spring
8. Spring retainer
9. Primary cup
10. Washer
11. Secondary piston
12. Secondary cups
13. Spring retainer

Test 6

1. Lower control arm assembly
2. Stabilizer bushing
3. Control arm shaft
4. Shims
5. Upper control arm assembly
6. Upper ball joint
7. Bumper
8. Grommet
9. Stabilizer shaft
10. Shock absorber
11. Stabilizer link

Test 7

1. Rear housing
2. Push rod
3. Press on boot
4. Piston
5. Cup
6. Spring
7. Bleed screw
8. Cup
9. Piston
10. Press on boot
11. Push rod
12. Front housing

Test 8

1. Transfer tube fitting
2. Calliper inner
3. Calliper outter
4. Ventilated disc
5. Piston
6. Piston seal
7. Dust boot
8. Bleed screw
9. Brake tube inlet
10. Lock washer
11. Bridge bolt
12. Cooling fins
13. Shoe and lining assembly

Test 9

1. Adaptor
2. Shoe and lining
3. Shoe and lining
4. Caliper
5. Bushing outer
6. Seal
7. Boot
8. Piston
9. Inner bushing
10. Positioner
11. Pin
12. Pin
13. Positioner
14. Inner bushing
15. Bleeder screw
16. Anti-rattle spring